UNIT IV

**CONTINGENT CROP PLANNING FOR ABERRANT WEATHER CONDITIONS, CONCEPT, OBJECTIVE, PRINCIPLES AND COMPONENTS OF WATERSHED MANAGE MENT, FACTORS AFFECTING WATERSHED MANAGEMENT**

**CONTINGENCY CROP PLANNING**

**Contingency Planning:** Things which you do not hope happen more frequently than things which you do hope. By Plautus. (C.254-184 B.C.), Mostellaria, Act I, Scene 3, 40 (197).

**Introduction**

* Planning for the unexpected event, when the use of technology is disrupted and business operations come close to a standstill.
* Procedures are required that will permit the organization to continue essential functions if information technology support is interrupted.
* Over 40% of business that don’t have a disaster plan go out of business after a major loss.

**What is Contingency Planning?**

* The overall planning for unexpected events is called contingency planning CP).
* It is how organizational planners position their organizations to prepare for, detect, react to, and recover from events that threaten the security of information resources and assets.
* Marginal goal: Restoration to normal modes of operation with minimum cost and disruption to normal business activities after an unexpected event.

**CP Components**

* **Incident response** **planning** (IRP) focuses on immediate response.
* **Disaster recover** **planning** (DRP) focuses on restoring operations at the primary site after disasters occur.
* **Business continuity** **planning** (BCP) facilitates establishment operations at an alternate site.

**This throws light upon the six types of contingent crop plans:**

1. Inadequate and Uneven Distribution of Rainfall,
2. Long Gap in Rainfall,
3. Early Onset of Monsoon,
4. Late Onset of Monsoon,
5. Early Cessation of Rains and
6. Prolonged Dry Spells.

**Contingent crop plans:**

1. **Inadequate and Uneven Distribution of Rainfall:** In general, the rainfall is low and highly variable which results in uncertain crop yields. Besides its uncertainty, the distribution of rainfall during the crop period is uneven, receiving high amount of rain, when it is not needed and lack of it when crop needs it.
2. Cultivation of low water required crops
3. Short duration crops grown
4. Providing lifesaving irrigation.
5. **Long Gap in Rainfall:**
6. Increase in seed rate to obtain more population
7. Spraying of urea solution
8. Providing lifesaving irrigation at critical crop growth stages
9. Weeding and intercultural operation.
10. **Early Onset of Monsoon:** Cultivate crop like pearl millet, sesamum etc.
11. **Late Onset of Monsoon:**
* Due to late onset of monsoon, the sowing of crops is delayed resulting in poor yields.
1. Alternate crop and varieties: Castor, green gram, cowpea, sunflower.
2. Dry sowing / Kura sowing,
3. Pre sowing,
4. Seed soaking / treatment,
5. Transplanting of one month old Bajra seedlings.
6. Complete weed control,
7. Grow legumes / oilseed crops in place of cereals and
8. Most suitable crop for this condition sunflower.
9. **Early Cessation of Rains:**
* Sometimes train may cease very early in the season exposing the crop to drought during flowering and maturity stages which reduces the crop yields considerably:
1. Select short duration varieties,
2. Using mulching / mulches,
3. Lifesaving irrigation applied,
4. Decrease in plant population.
5. **Prolonged Dry Spells:**
* Long breaks in the rainy season are an important feature of Indian monsoon. These intervening dry spells when prolonged during crop period reduces crop growth and yield and when unduly prolonged crops fail.
1. If dry spell in 10 days of sowing, re-sowing.
2. If mild moisture at 30-35 days after sowing, thinning of alternate rows of sorghum and pearl millet.
3. If severe moisture stress at 30-35 days after sowing, cutting of sorghum and pearl millet and ratooning.
4. If moisture stress at blooming stage, cutting of sorghum and pearl millet and ratooning.
5. Breaking of monsoon for short while, shallow inter cultivation for eradicating weeds / soil mulch.
6. Wider spacing for moisture conservation.

**CONTINGENCY CROP PLANNING UNDER ABERRANT WEATHER STUDY FROM PDF**

**WATERSHED MANAGEMENT**

**Concept, objective, principle and components of watershed management, factors affecting watershed management**

**Introduction**

* Soil water and vegetation are the important natural sources.
* As these resources are independent there is a need to have a unit of management for most effective and useful management of these resources.
* In this context, watershed is an important unit for the management of natural resources.

**Concept of watershed management:**

* **A watershed is defined as any spatial area from which runoff from precipitation is collected and drained through a common point or outlet.**
* **It is defined as unit area, which covers all the land, which contributes runoff to a common point. It is synonymous with a drainage basin or catchment area.**
* The basic unit of development is a watershed, which is a manageable hydrological unit. The watershed is also known as ridgeline in UK.
* As the entire process of Agricultural development depends on status of water resources, watershed with distinct hydrological boundary is considered ideal for planning developmental programmes.
* It is essential to have various development programmes on watershed basis in conjunction with basic soil and water conservation measures.
* The development activities need to be taken up from ridgeline to outlet point (ridge to valley).
* Watershed management programme in dry lands aimed at optimizing the integrated use of land, water and vegetation in an area for providing an answer to alleviate drought, moderate floods, prevent soil erosion, improve water availability and increase food, fodder, fuel and fiber on sustained basis.

**Watershed management**

* Watershed management implies the wise use of soil and water resources within a given geographical area so as to enable sustainable production and to minimize floods.
* Watershed management is the rational utilization of land and water resources for optimum production with minimum hazard to natural resources.
* Watershed management has been taken up under different programmes launched by Government of India.
* **The Drought Prone Area Development Programme (DPADP) and the Desert Development Programme (DDP) adopted watershed development approach in 1987.**
* **The Integrated Watershed Development Project (IWDP) taken up the National Watershed Development Board (NWDB) in 1989 also aimed at development of wasteland on watershed basis.**
* The fourth major programme based on watershed on watershed concept is the National Watershed Development Programme for Rainfed Areas (NWDPRA) under the ministry of Agriculture. The ministry of rural development funds watershed development schemes under DDP, DPAP and IWDP.

 **CLASSIFICATION OF WATERSHED**

1. **Based on size:** Small, medium and large
2. **Based on shape:** Fern shape and fan shape
3. **Based on drainage:** Catchment and drainage basin
4. **Based on land use pattern:** High land watershed, tribal settlement, settled cultivation watershed.

 **Watershed based on size:**

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Watershed class** | **Size (ha)** |
|  | Region  | Greater than 300 lakhs |
|  | Basin | 30-300 lakh |
|  | Catchment | 10-30 lakh |
|  | Sub-catchment | 2-10 lakh |
|  | Watershed | 50000-200000 |
|  | Macro watershed | 50000 |
|  | Sub-watershed | 10000-50000 |
|  | Miliwatershed | 1000-10000 |
|  | Micro watershed | 100-1000 |
|  | Mini watershed | 1-100 |

 **Major Problems of Watersheds:**

* Land degradation due to excessive runoff.
* Improper land use
* Unequal distribution of water: Due to development of water harvesting structures at upstream regions, water flow reduces significantly into the downstream regions, reservoirs.
* Problems of droughts during dry spells due to inadequate management.
* Flooding and landslides during peak season due to inadequate management.
* Deposition of silt and water loggings in fields.
* Excessing cropping.
* Shifting cultivation.
* Slope cultivation.
* Over grazing
* Human animal pressure.
* Lack of technical knowledge for various biophysical and socio-economic issues.
* Political conflicts (e.g. due to lack of funds, should be solved on priority basis.

 **Deterioration of watershed:**

* It caused due to faulty use and improper management.
* Adoption of faulty agriculture, forestry and pasrure management practices.
* Fire consequences.
* Unscientific mining and quarrying.
* Alignment and construction of roads in faulty way.
* Extension of industrial activities.

 **PRINCIPLES OF WATERSHED MANAGEMENT**

* Utilizing the land based on its capability
* Protecting the fertile top soil
* Minimizing the silting up of the reservoirs and lower fertile lands
* Protecting vegetative cover throughout the year
* In situ conservation of rain water
* Safe diversion of surface runoff to storage structures through grassed water ways.
* Stabilization of gullies and construction of check dams for increasing ground water recharge.
* Alternate land use systems for efficient use of marginal lands.
* Water harvesting for supplement irrigation.
* Ensure sustainability of the ecosystem.
* Maximizing farm income through agricultural related activities such as dairy, poultry, sheep and goat farming.
* Improving infrastructure facilities for storage, transport and marketing.
* Setting up of small scale agro industries and
* Improving socio-economic status of farmers.

 **OBJECTIVES OF WATERSHED MANAGEMENT**

* **To control damaging runoff and degradation and thereby conservation soil and water.**
* **To manage and utilize the runoff water for useful purpose.**
* **To protect, conserve and improve the land of watershed for more efficient and sustained production.**
* **To protect and enhance the water resources originating in watershed.**
* **To check soil erosion and to reduce the effect of sedimentary yield on the watershed.**
* **To rehabilitate the deteriorating lands.**
* **To moderate the flood peaks at downstream areas.**
* **To increase infiltration of water.**
* **To improve and increase production of timber, fodder and wild life resource.**
* **To enhance groundwater recharge.**

 **The objectives of watershed management programme can also be described in symbolic form by expression: POWER. Here the letters symbolize the following:**

* **P= Production of food-fodder-fuel-fiber-fish-milk combined on sustained basis, pollution control and prevention of floods.**
* **O= Over exploitation of resources to be minimized by controlling excessive biotic interferences like over grazing.**
* **- Operational practicability of all on farm operations and follow up programmes including easy approachability to different locations in watershed.**
* **W= Water storage at convenient locations for different purposes.**
* **- Wild animal and indigenous plant life conservation at selected places.**
* **E= Erosion control.**
* **- Economy.**
* **- Ecosystem safety.**
* **- Employment generation.**
* **R= Recharge of ground water.**
* **- Reduction of drought hazards.**
* **- Reduction of siltation in multipurpose reservoirs.**
* **-Recreation.**

 **COMPONENTS OF WATERSHED MANAGEMENT**

* The main components of watershed programme are:
1. **Soil and water conservation**
2. **Water harvesting**
3. **Crop management**
4. Alternate land use systems
5. Afforestation
6. Pasture / fodder development
7. Human resource development
8. Livestock management
9. Rural energy management
10. Farm and non-farm activities.

Out of all these first three are main components.

 **Soil and water conservation measures**

These measures coupled with water harvesting help to improve the moisture availability in the soil profile and surface water availability for supplement irrigation. Based on the nature and type of hydraulic barriers and their cost the conservation measures in arable lands can be divided into three categories:

1. Permanent treatments
2. Semi-permanent treatments
3. Temporary treatments
4. **Permanent measures:** These measures are provided for improvement of relief, physiography and drainage features of watershed, aimed at controlling soil erosion, regulating surface runoff and reducing peak flow rates. Bunds, terraces and waterways are the permanent measures in watershed management projects.

**Waterways:** Both with and without vegetation- grassed waterways for safe disposal of runoff water.

**Bunds:** Contour bunds- Suitable for low rainfall areas (less than 600 mm) and in permeable soil having slope up to 60%.

**Graded bunds**: Suitable for high rainfall areas (greater than 600 mm) and for poor permeable soils having 2-6% slope.

**Terraces: Bench terrace-** suitable for soils having slopes 16-33%. Bench terraces reduce both slope length and degree of slope.

1. **Semi-permanent measures**: These are usually inter bund treatments where field size are large in conventionally bonded area. They are adopted to minimize the velocity of overland flow. These measures may have lost for 2 to 5 years.
2. **Small section / key line buunds:** A small section bund may be created across the slope at half of the vertical bund spacing, which needs to be renovated at an interval of 2-3 years.
3. **Strip leveling:** Leveling of about 4 to 5 m strips of land above the bund across the major land slope help in reducing velocity of surface flow. Strip leveling can be done by running blade harrow at an interval of 2 to 4 years.
4. **Vegetative or live barriers:** One or two barriers of close growing grasses or legumes along the bund and at mid length of slope can filter the runoff water or slow down over land flow. Khus grass is widely recommended as vegetative barrier.
5. **Temporary treatments:** These are simple treatments for in situ moisture conservation and needs to be remade or renovation every year.

Simple practices like contour farming, compartmental bunding, broad bed and furrows, dead furrows, tillage and mulching have gained wide acceptance in the recent past.

1. **Water harvesting:** The water harvesting structures and the use of harvested water for life saving irrigation in watershed areas.
2. **Crop management:** Location specific package of practices for dry land crops have been developed by dry land research centers and state agricultural universities for all the crops and cropping systems which include.
3. Selection of crops and cropping systems to suit length of growing season.
4. Optimum sowing time,
5. Fertilizer schedules and balanced use of plant nutrients for crops and cropping systems.
6. Weed management and package of practices for aberrant weather.
7. Contingent cropping.

 **Factors affecting watershed management:**

**Factors affecting watershed management**

**a) Watershed characters**

i) Size and shape
ii) Topography
iii) Soils
iv) Relief

**b) Climatic characteristic**

i. Precipitation
ii. Amount and intensity of rainfall

**c) Watershed operation**

**d) Land use pattern**

i. Vegetative cover
ii. Density

**e) Social status of inhability**

**f) Water resource and their capabilities.**

**Watershed management practices**
1. Interms of purpose
1. To increase infiltration
2. To increase water holding capacity
3. To prevent soil erosion
2. Method and accomplishment

In brief various control measures are:
1. Vegetative measures ( Agronomical measures)
1. Strip cropping
2. Pasture cropping
3. Grass land farming
4. Wood lands
2. Engineering measures ( Structural practices 0
1. Contour bunding
2. Terracing
3. Construction of earthern embankment
4. Construction of check dams
5. Construction of farm ponds
6. Construction of diversion
7. Gully controlling structure
1. Rock dam
2. Establishment of permanent grass and vegetation
8. Providing vegetative and stone barriers
9. Construction of silt tanks distension.